Sustainable Irrigation Strategy for the Babai Area in Nepal

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I. Introduction

The study area in south western *Nepal* consists of 6 farmer managed irrigation systems (FMIS) with their specific water rights and institutions, newly developed extension parts and dry lands as shown in Figure 2. This study aims at finding ways to provide year round irrigation to the total 30,6000 ha area while at present there is acute water shortage in the *Babai* river during 8 months of the dry season even to irrigate the FMIS. A new concept of water harvesting using local reservoirs and conjunctive use of groundwater is found sustainable and user friendly.

II. Materials and Methods

Field study: a field study was conducted in November 2006 to explore the existing situation. Meteorological data, previous study reports and canal geometric data were obtained from the project office.

Alternate solution: To cope with the water deficit this study proposes a link canal from the *Karnali* to irrigate the 7,500 ha dry area as an extension of the *Betahani kulo* as shown in Fig 2. The rest area depending on the *Babai* river flows at the left and right banks as shown in Table 1 is then analyzed.

Table 1. Area to be irrigated from the *Babai* flows, (ha)

	Left bank	Right bank
FMIS	5,400	3,900
Extension part	8,100	2,100
Total	13,500	6,000

III. Results and Discussions

Crop water requirements: Water requirements for selected 6 crops are calculated using the formula:

$$CWR_{ij} = \sum_{l=1,6} IRA_l \left[(ETo_{ij} * kc_{lij} + DP - ER_{ij}) / FE_l \right] \quad (1)$$

Where CWR_{ij} is the total crop water requirement during the j^{th} half month of the i^{th} month, IRA_l is the irrigated area of the l^{th} crop, ETo_{ij} is the evapotranspiration in jth half month of i^{th} month, kc_{lij} is the crop coefficient of the l^{th} crop at j^{th} half month of the i^{th} month, DP is the deep percolation and equals 3 mm per day for rice and zero for other crops, ER_{ij} is the effective rainfall of corresponding periods and FE_l is the field application efficiency for crop l.

Water balance: The designed cropping intensity (CI) using the *Babai* river flows maintaining the existing water rights at the east FMIS, extension and at the west is 179, 118 and 183 percent as shown in Fig 1.

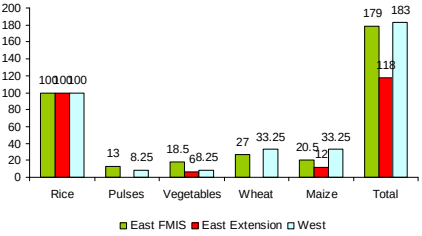

Figure 1. Cropping pattern at different blocks based on the established water rights

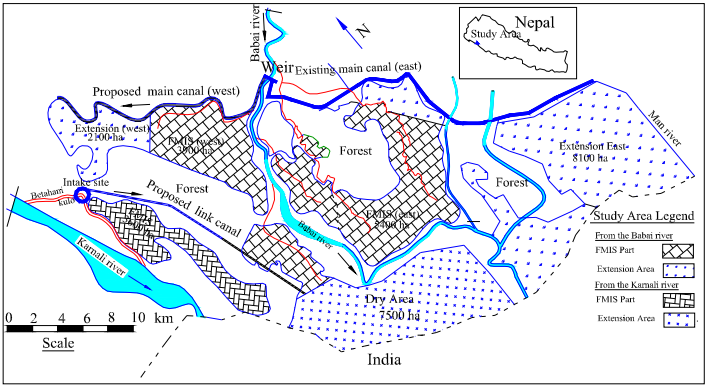

Figure 2 The study area showing the *Babai* and *Karnali* rivers and irrigation blocks.

Water deficit: The water supply and demand from January to June at a CI of 250% in the total area to be served from the *Babai* river flows after allocating 10% discharge for the downstream ecosystem is shown in Fig 3. It shows a clear deficit of water from February to May.

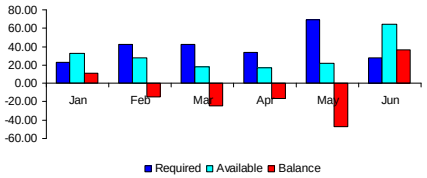

Figure 3. Overall water deficit in February-May at a CI of 250%, $10^6 m^3$.

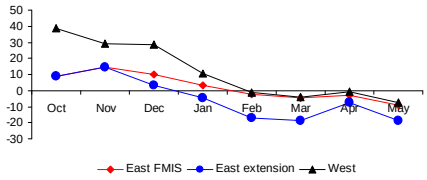

Figure 4. Block wise water scenario from October to May for a CI of 250%, $10^6 m^3$

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Strategy to make up the deficit: Figure 4 shows that there is surplus water in months of June to December which can be stored in local reservoirs. Water harvesting is being practiced in the study area since long ago using local reservoirs of about 70 ha area. Groundwater exploitation is another viable option due to its easy access and low cost. Irrigated monsoon rice in the full area is like an artificial wetland where the water pool greatly contributes to the groundwater recharge. Analyzing Figure 4 it can be concluded that the east FMIS and the west side can easily get full irrigation during the dry period only by water harvesting and the extension part will need a combination of water harvesting and groundwater pumping for a sustainable year round irrigation.

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